Motivational antecedents of incident reporting: evidence from a survey of nurses and physicians

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Summary

QUESTIONS UNDER STUDY: Underreporting is a major issue when using incident reporting systems to improve safety in hospitals. Based on a psychological framework, this study investigated the motivational antecedents of the willingness to report into incident reporting systems in healthcare. Individual, organisational and system-related influences on the willingness to report incidents were investigated in a survey of physicians and nurses from five Swiss hospitals.

METHODS: The motivational antecedents were tested using structural equation modelling. The sample consisted of 818 respondents, 546 nurses and 230 physicians; the response rate was 32%. The willingness to report was assessed by using a self-report scale, validated with the self-reported number of reported incidents during the previous year.

RESULTS: The most important influence on the willingness to report was the transparency of the incident reporting system procedures to potential users, such as. knowing how and what kind of events to report. At the individual level, the perceived effectiveness of reporting was a relevant antecedent. At the organisational level, management support positively influenced the willingness to report. Different antecedents were found to be relevant for nurses and physicians.

CONCLUSIONS: Implications are discussed that open up alternatives for the design and implementation of incident reporting systems in healthcare. For example, the results of the study point to opportunities for making incident reporting systems more transparent and participatory and to allow for experience of how they actually improve patient safety.

Key words: incident reporting systems in healthcare; patient safety; willingness to report; motivation to report incidents; underreporting

Introduction

Incident reporting systems in healthcare

Hospitals aim to develop organisational structures for improving the safety of patient care. Incidents, errors and near-misses (hereafter referred to as incidents) offer fundamental insights into the processes of how things are done and what could be improved [1, 2]. Therefore, incident reporting systems (IRS) are increasingly implemented in order to learn from incidents [3, 4]. They are expected to offer "free lessons" [1] for identifying accident-prone practices and hazards for patient safety. After analysing reported incidents, corrective actions can be defined to improve safety.

Studies on incident reporting have shown that underreporting occurs to a large extent. Barach and Small [5] estimated 50%–90% underreporting of adverse events annually. Only if incidents are reported, can the IRS serve effectively as an instrument for learning from incidents and promote system improvements. Therefore, barriers that prevent clinicians from reporting are discussed as a major problem for incident reporting in healthcare (for a review of them, see [6]).

Pfeiffer et al. [6] systematised the barriers for incident reporting and proposed a psychological framework for a theoretically driven examination of the factors influencing the motivation to report to IRS in healthcare. What is unique about the framework is that barriers towards reporting incidents are conceptualised as detrimental influences on the willingness to report incidents. This also allows for factors enhancing the willingness to report to be included; thus using the willingness to report as the outcome variable makes comparisons of different influencing factors (i.e. antecedents) possible.

Evidence from prior studies suggests that physicians are more reluctant to report incidents than nurses: they perceived more barriers to reporting [7] and reported significantly fewer incidents than nurses. Physicians often did not know that an IRS existed, whereas most of the nurses did [8]. Braithwaite et al. [9] found that physicians were less likely to report incidents or to express favourable attitudes

towards reporting than nurses were. Similarly, Kingston et al. [10] reported that nurses reported incidents more habitually than physicians.

Aims of the study

While prior studies on the reasons for underreporting assessed potential barriers to incident reporting and the degree to which respondents agreed with them, we decided to use an outcome variable to allow for comparative testing of the relevance of different potential barriers. Relying on the framework of Pfeiffer et al. [6], the willingness to report was defined as the outcome variable, being an indicator for actual reporting behaviour. Thus, in analysing the impact of potential barriers on the willingness to report, we were able to identify which of them are relevant antecedents of the willingness, i.e. the motivation to report. The framework on which this study relies differentiates motivational antecedents on individual, organisational and IRS-related levels. Therefore, the two main aims of the study were to empirically identify (1.) the relevant antecedents for clinicians' willingness to report on individual, organisational and IRS-related levels, and to investigate (2.) whether there are different antecedents relevant for physicians versus for nurses. The overall aim was to use the conclusions for advancing the design of IRS in hospitals.

Motivational antecedents for the willingness to report incidents

In the following section, our hypotheses about the antecedents for the willingness to report as well as their foundations in prior research are presented. Based on the framework by Pfeiffer et al. (see [6]), we differentiate antecedents at individual, organisational and system-related levels.

Individual level antecedents for the willingness to report

The underlying framework relies on the theory of reasoned action [11] in differentiating personal attitudes and subjective norm influencing an individual's intention, i.e. willingness to report.

Personal attitudes
The personal attitudes towards a specific behaviour consist of beliefs about possible consequences of that behaviour. The following attitudes towards reporting behaviour have been identified in prior research and were investigated in this study: *Perceived effectiveness of reporting*, i.e. the extent to which staff hold the belief that IRS are effective in enhancing patient safety [8, 12, 13, 14] and *fears and concerns* related to the reporting of an incident, i.e. fear of disciplinary consequences or fear that one's own or a colleague's competence may be questioned [10, 15, 16].

Subjective norm
The intention to exert a specific behaviour is also influenced by an individual's perception that relevant others within the organisation (e.g. colleagues, supervisors) expect him or her to do so [11]. Wu et al. [17] showed that subjective norm was a relevant factor for explaining the acceptance of an IRS.

The following hypotheses were tested at the individual level:
Hypothesis 1 (H1): The perceived effectiveness of reporting has a positive influence on the willingness to report.
Hypothesis 2 (H2): Fears and concerns have a negative influence on the willingness to report.
Hypothesis 3 (H3): Subjective norm has a positive impact on the willingness to report incidents.

Role identity
With regard to the prediction of repeated behaviour (which incident reporting is expected to be), role identity was proposed to be integrated into the theory of reasoned action as an influence on the behavioural intention [18]. Role identity is a set of characteristics and expectations that is defined by an individual's social position in a community and that has been internalised as a part of the self-concept [19]. We therefore expect that role identity has an influence on the personal attitudes and the subjective norm and thus helps to explain willingness to report [20].
Hypothesis 4 (H4): Role identity has an influence on personal attitudes (i.e. perceived effectiveness, fears and concerns, and subjective norm).

Organisational level antecedents for the willingness to report

As incident reporting is a type of proactive behaviour [21], it is important to identify which organisational perceptions support this behaviour. We focused on the relevance of psychological safety and management support for patient safety as antecedents for the willingness to report for the following reasons:

Psychological safety
Psychological safety describes the perception that staff is at ease to bring up own ideas and errors. It has been shown to influence reporting behaviour [4, 22] and learning from errors [23, 24].

Management support
Management support was shown to be an important success factor contributing to incident reporting [17, 25, 26, 27]. Thus, clinicians perceiving their management as being active in enhancing patient safety and fostering incident reporting are expected to be more willing to report.
Hypothesis 5 a, b (H5a,b): The perception of organisational dimensions (a: psychological safety, b: management support) has a positive influence on the willingness to report.

Incident reporting system-related antecedents for the willingness to report

Prior research identified motivational antecedents to incident reporting that were related to the functioning and implementation of the IRS [6]. We focused on three topics for investigating the relevance of IRS characteristics for the motivation to report incidents:

Transparency of reporting procedure to potential users
This dimension covers the extent to which potential users know what kind of events to report [12, 13], how and where a report is to be made [13, 28] if the reporting form is

considered appropriate [9, 16] and whether they feel adequately trained for reporting incidents.

Feedback
A lack of feedback following reported incidents and the actions that were taken to address them was reported as a complaint of users in prior research [12, 13, 15].

Trust in the IRS
This dimension covers the extent to which clinicians trust that the analysis procedure of the IRS is done confidentially and by competent persons. Prior research reported that a lack of trust in the competence and confidentiality was a barrier to reporting incidents [29, 30, 31].
Hypothesis 6, a–c (H6a–c): The positive evaluation of the IRS-related perceptions (a: transparency, b: feedback, c: trust) has a positive effect on the willingness to report.

Methods

Sample
We selected a purposeful sample of five hospitals of different size covering the three language regions of Switzerland: one hospital from the Italian-speaking part of Switzerland, one from the French-speaking part, two from the German-speaking part and one from the bilingual (German/French) part of Switzerland. This sample included three regional hospitals, one cantonal hospital and one university hospital.

Within these hospitals we included only units that had implemented and actively run an IRS for more than a year. All the IRS that we studied allowed for anonymous reporting. Characteristics of the IRS were checked in a preliminary interview with the risk manager responsible for each hospital's IRS. The paper-and-pencil surveys were distributed by each hospital's risk manager and returned directly to the researchers.

The response rate was 32% (i.e. 818 analysable questionnaires). The sample comprised 546 nurses and 230 physicians and 42 respondents with other professional backgrounds. Participating clinical staff was based in surgery (23.4% of the sample), internal medicine (13.2% of the sample), anaesthesia (15.5% of the sample), intensive care (21.9% of the sample), and gynaecology (26.1% of the sample).

Because the data for this study were pooled across five organisations (with 18 units stemming from five disciplines),

we used a regression analyses to test whether there was an influence of these unit and discipline variables on the willingness to report scale in. There was no significant influence and corrected R2 (explained variance) was only 1%.

To enhance trust in the anonymity of the study and to foster a high response rate, demographic information was kept to a minimum; i.e. only unit and professional group were requested. A prior study [7] which noted age, gender, and years in the profession showed no significant influence on barriers towards incident reporting.

Measure: Survey contents and development
The response format ranged on a Likert scale from 1 (*disagree strongly* or *very rarely*) to 5 (*agree strongly* or *almost always*). The numbers of items per dimension are shown in table 1.

Outcome variable
Self-reported willingness to report incidents was a valid predictor for reporting behaviour [32] and was used in other studies in healthcare [30, 33]. We developed a four-item scale asking for (1.) previous reporting, (2.) the intention to report incidents in future, (3.) frequency of reported incidents in relation to the experienced ones and (4.) whether one motivates colleagues for reporting. Cronbach's Alpha was $\alpha = 0.80$. For validation, the correlation to the self-reported number of incident reports during the last year was examined. Splitting the respondents into three groups (0 incidents reported, n = 199; 1–2 incidents reported, n = 233; 3 or more incidents reported, n = 195), the correlation to the summated score of *willingness to report* was r= 0.50.

Individual level
Items relating to *perceived effectiveness* addressed (1.) the general opinion that reporting incidents has an effect on patient safety, (2.) that reporting allows others to learn from the incident and (3.) that reporting helps avoid the reoccurrence of the same type of incidents. *Fears and concerns* asked for fears of (1.) being regarded as incompetent, (2.) making colleagues look incompetent and (3.) disciplinary consequences after a report. For assessing *subjective norm*, respondents rated the extent to which they feel that their leaders and their colleagues (belonging to their own and to other professional groups) expect them to report incidents (four items). Items assessing *role identity* as a team member (two items) and as a hospital employee (two items) were adapted from the role-person merger scale [34].

Table 1: Overview of assessed dimensions.

Level	Dimension	Number of items
Individual	Fears and concerns	3
	Perceived effectiveness	3
	Subjective norm	3
	Role identity	4
Organisational	Psychological safety	3
	Management support	2
IRS-related	Feedback	3
	Transparency of reporting procedure	4
	Trust	2
Outcome	Willingness to report	4
Item content descriptions are displayed in tables 2, 4, and 6		

Organisational level

Three items assessed *psychological safety*: (1.) how much employees feel accepted in their unit, (2.) whether they feel that everybody in their unit has freedom of speech and (3.) whether there are people in their unit who would deliberately undermine efforts of others. Two items assessed the perceived extent of the *management support:* (1.) regarding patient safety in general and (2.) incident reporting specifically.

Perceptions of incident reporting system

Based on the barriers found in prior studies [6], we developed items assessing the IRS-perceptions. For *transparency of the reporting procedure*, four items asked how clear it was regarding (1.) what kind of events to report, (2.) how to proceed in reporting, (3.) how to fill in the form and (4.) whether the respondents felt adequately trained. For *feedback*, the respondents rated the extent to which they feel informed about (1.) reported incidents, (2.) the consequences taken from reported incidents and (3.) to what extent they perceive that changes are implemented based on reports. *Trust* in the IRS was assessed by asking the extent to which (1.) the respondents felt that competent persons did the analysis and (2.) they trusted that confidentiality during IRS procedures was maintained.

Translation into German, French and Italian

First, a German version of the questionnaire was evaluated using experts from healthcare (nurses and physicians) in pretests. The translated French and Italian versions were pretested with healthcare workers, asking them to think aloud while answering. The two researchers conducting these pretests were the same for each language version (and able to speak all three languages), so that items that were understood differently could be identified across all the versions. After the pretests, the translators checked again for the correctness of the changed items. Cronbach's Alpha of the scales was checked for each language version and the items had comparable item-to-total correlations.

Analysis

Firstly, we calculated means and standard deviations (SDs) for all dimensions of the survey measuring the constructs relevant to our study. Secondly, the individual, organisational and IRS-related impacts were identified in subsequent, separate structural equation model analyses comprising a combination of exploratory factor analysis and multiple regression analysis [35]. Thirdly, a model integrating all relevant influences resulting from the three analyses was tested. Finally, professional group differences were investigated using multi-group analysis.

Only items with good measurement properties were included in structural model analyses. We therefore analysed the local fit of the items in confirmatory factor analyses. Specifically we tested for convergent and discriminant validity. Convergent validity assumes that the indicators of a specific construct should share a high proportion of variance in common. The following criteria were used to decide a good convergent validity: indicator reliability >0.40, factor reliability >0.60, average variance extracted (AVE) >0.50. Discriminant validity describes the extent to which

a construct in a model is truly distinct from another construct in that model. To confirm discriminant validity of the factors, the Fornell-Larcker ratio (FLR), which assumes that the average variance extracted of one construct should be greater than the highest squared intercorrelation of that construct with any other construct in the model. For this study required FLR was defined as <1.0.

In structural equation modelling, the overall quality of the model needs to be established using fit indices before then establishing whether specific paths in the model are significant. For assessing global fit, the following indices were applied: the ratio of chi-square divided by degrees of freedom (CMIN/df <3.0: acceptable, <5.0: debatable), goodness-of-fit index (GFI >0.90 or >0.95), root mean square error of approximation (RMSEA <0.08 or <0.05), test of close fit (PCLOSE >0.50), normed fit index (NFI >0.90 or >0.95), Tucker-Lewis index (TLI >0.90 or >0.95) [35, 36]. Modification indices were checked for the structural analyses; they indicate the estimated decrease of the CMIN value in case a certain relation was modelled.

In order to obtain full datasets, we calculated missing data using the EM-algorithm. For structural equation modelling, we applied the statistical software IBM SPSS AMOS 20. Normal distribution was examined by visually confirming that the histograms of each item conformed to normal distribution. Since parameter estimates based on maximum likelihood are relatively robust from deviations from normality [35], they were applied for the analyses.

Results

The means and standard deviations (SDs) of the dimensions of the survey are included in tables 2, 4, and 6.

Individual dimensions

Measurement model

The global fit of the measurement model was acceptable (CMIN/df = 5.447, GFI = 0.918, RMSEA = 0.074, PCLOSE = 0.000, NFI = 0.893, TLI = 0.888; see methods section for the applied criteria). The local fit was good (table 2). Fornell-Larcker ratios point to discriminant property of the latent constructs. We kept the two items yielding an indicator reliability lower than 0.40 because they covered important aspects. The outcome variable *willingness to report* had reliable items and was discriminant to the other dimensions.

Structural model

As the modification index was high for a direct effect from *subjective norm* on *perceived effectiveness* (MI= 49.1), and because conceptually it made sense, this path was included in the structural model. The most relevant individual influence on the *willingness to report* was the *perceived effectiveness* of the IRS (H2, table 3). As hypothesized (H1, hypothesis one) *fears* had a negative impact on the *willingness to report* and (H3) s*ubjective norm* had a positive effect on it. *Role identity* (H4) had a positive influence on *subjective norm* and *perceived effectiveness* of the IRS, and had a negative effect on the *fears and concerns* related to IRS. The global fit of the structural model was moderate.

Organisational dimensions

Measurement model

The global fit of the measurement model was good (CMIN/df = 3.166, GFI = 0.980, RMSEA = 0.051, PCLOSE = 0.402, NFI = 0.965, TLI = 0.964). The local fit was good for the dimensions *psychological safety* and *willingness to report* and it was acceptable for *management support* (table 4). The item asking whether management "is engaged for patient safety" had an indicator reliability below 0.40, which was reflected by a lower AVE of the dimension. Since the extent to which the management is perceived to support patient safety was considered important, it was kept. Fornell-Larcker ratios below 1.0 indicated discriminant properties of the latent constructs.

Structural model

The structural model showed a good fit (table 5). *Management support* had a significant positive effect, and *psycho-*

logical safety had a small negative effect on the *willingness to report*. This may be due to a suppressor effect since the latent constructs of *psychological safety* and *management support* correlated (standardised r = 0.25). To sum up, H5 was partially supported for the *management support* dimension.

IRS-related dimensions

Measurement model

The global fit of the measurement model was moderate (CMIN/df = 4.389, GFI = 0.950, RMSEA = 0.064, PCLOSE = 0.002, NFI = 0.936, TLI = 0.934). The local fit (table 6) was good (only three items had an indicator reliability slightly below 0.40). The discrimination between the constructs was rather low, indicated by high Fornell-Larcker ratio values. This may be because all the dimensions, including the outcome variable *willingness to report*, related to what respondents think about their IRS.

Table 2: Local fit of the individual level dimensions.

Factor (scale)	Mean, SD	Indicator (item)	Reliability of indicator	Reliability of factor	AVE	FLR
Fears and concerns		Fear of being regarded as incompetent	0.73	0.85	0.60	0.07
	2.7, 1.0	Fear of disciplinary action	0.49			
		Fear of making co-workers look bad	0.74			
Perceived effectiveness	4.0, 0.8	Supports learning from incidents	0.72	0.76	0.70	0.23
		Supports avoiding repetition of incidents	0.61			
		Improves patient safety	0.27			
Subjective norm		Expectation of my supervisor	0.31	0.77	0.45	0.46
	3.6, 0.9	Expectations of co-workers of my professional group	0.87			
		Expectations of co-workers of other professional groups	0.44			
Role identity	3.9, 0.7	Work in team is important	0.57	0.81	0.53	0.21
		Feel related to team	0.59			
		Hospital important as workplace	0.43			
		Feel related to hospital	0.56			
Willingness to report	3.3, 0.9	Reported in the past	0.54	0.81	0.53	0.29
		Will report in the future	0.52			
		Frequency of reported in relation to occurred incidents	0.53			
		Motivate co-workers to report	0.53			

n= 818; abbreviations of fit indices explained in "Analysis" section

Table 3: Path coefficients and general fit indices of the structural model: individual impacts.

	Unstandardised	Standardised
Willingness to report	$R^2 = 0.210$	
Fears and concerns → Willingness to report	−0.16**	−0.16
Perceived effectiveness → Willingness to report	0.47**	0.29
Subjective norm → Willingness to report	0.22**	0.21
Fears and concerns	$R^2 = 0.036$	
Role identity → Fears and concerns	−0.30**	−0.19
Perceived effectiveness	$R^2 = 0.215$	
Role identity → Perceived effectiveness	0.28**	0.24
Subjective norm	$R^2 = 0.134$	
Role identity → Subjective norm	0.67**	0.37
Fit indices	CMIN = 434.503; df = 110	
	p <0.000	
	CMIN/df = 3.950	
	GFI = 0.941	
	RMSEA = 0.060	
	PCLOSE = 0.003	
	NFI = 0.922	
	TLI = 0.926	

n = 818 * p <0.05. ** p <0.01; abbreviations of fit indices explained in "Analysis" section

Structural model

The structural model showed a moderate fit (table 7). The most significant influence on the willingness to report was the transparency of the reporting procedure. Feedback had no relevant influence; it correlated highly with the other two variables. Trust in the IRS has a positive influence on the willingness to report. To sum up, H6 was partially supported for transparency and trust, but feedback did not have a positive effect on the willingness to report as hypothesised.

Integrated model of most relevant motivational antecedents

The motivational antecedents that were most relevant in the analyses described above were included in the integrated model (figure 1). It was defined as parsimoniously as pos-
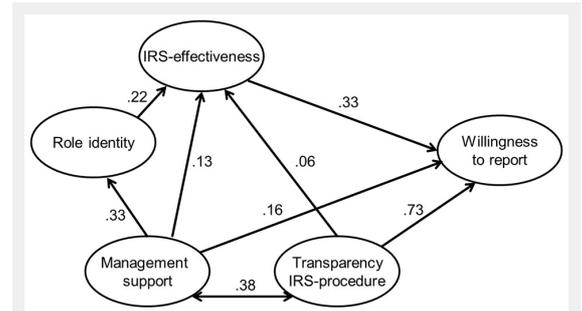
Figure 1

Integrated model of motivational antecedents, numbers indicating the unstandardised path coefficients.

Table 4: Local fit of the organisational dimensions.

Factor (scale)	Mean, SD	Indicator (item)	Reliability of indicator	Reliability of factor	AVE	FLR
Psychological safety	3.5, 0.8	Everyone is accepted	0.54	0.79	0.56	0.80
		Appreciate capabilities of each other	0.45			
		Have freedom of speech	0.67			
Management support	3.6, 0.9	Is engaged for patient safety	0.31	0.58	0.41	0.75
		Fosters reporting of incidents	0.57			
Willingness to report	3.3, 0.9	Reported in the past	0.57	0.82	0.54	0.59
		Will report in the future	0.47			
		Frequency of reported in relation to occurred incidents	0.55			
		Motivate co-workers to report	0.52			
n= 818; abbreviations of fit indices explained in "Analysis" section						

Table 5: Path coefficients and general fit indices of the structural model: organisational influences.

	Unstandardised	Standardised
Willingness to report	R^2 = 0.256	
Psychological safety → Willingness to report	−0.12	−0.08
Management support → Willingness to report	0.70**	0.54
Fit indices	CMIN = 75.99; df = 24	
	p < 0.001	
	CMIN/df = 3.17	
	GFI = 0.980	
	RMSEA = 0.051	
	PCLOSE = 0.402	
	NFI = 0.965	
	TLI = 0.964	
n = 818; * p <0.05. ** p <0.01; abbreviations of fit indices explained in "Analysis" section		

Table 6: Local fit of the IRS-related dimensions.

Factor (scale)	Mean, SD	Indicator (item)	Reliability of indicator	Reliability of factor	AVE	FLR
Feedback		Informed about consequences from event reports	0.71	0.80	0.60	0.82
	3.0, 1.1	Do not hear back after incident report (recoded)	0.39			
		Regularly informed about reported incidents	0.68			
Transparency of reporting procedure	3.8, 0.9	Know how to report	0.68	0.81	0.52	0.90
		Form easy to fill in	0.40			
		Feel trained for using IRS	0.50			
		Clearly defined which events to report	0.46			
Trust	3.7, 0.8	Trust in confidentiality/anonymity	0.42	0.56	0.40	0.70
		Event analysis done by competent people	0.36			
Willingness to report	3.3, 0.9	Reported in the past	0.61	0.81	0.54	0.70
		Will report in the future	0.44			
		Frequency of reported in relation to occurred incidents	0.56			
		Motivate co-workers to report	0.49			
n = 818; abbreviations of fit indices explained in "Analysis" section						

sible to allow for subsequent multigroup analysis. As the latent constructs were checked in prior analyses, examining the measurement model was not necessary. Modification indices pointed to direct effects between *management support* and *role identity* (MI = 77.32), between *management support* and perceived *IRS effectiveness* (M.I. = 22.77) and between *transparency* of IRS procedure and *IRS effectiveness* (MI = 19.51). The integrated model accounts for these effects, as they pointed to the interrelations between the different groups of predictors we had tested so far.

Transparency of IRS procedures was the most relevant motivational antecedent; *IRS effectiveness* was also important (table 8 and fig. 1). *Management support* had only a small influence on the *willingness to report*; however, it had an influence on *role identity*.

Perceived IRS-effectiveness was most influenced by *role identity*; *management support* had only a small effect and *transparency* had no effect on the *IRS-effectiveness*, which may be due to the intercorrelation of *transparency* and *management support*.

Differences between professional groups

The multigroup model achieved a better global fit than the model of the whole sample in terms of CMIN/DF, RMSEA, and PCLOSE and only a slightly worse fit for the other indices (table 9). With regards to *willingness to report, transparency* of the IRS showed the strongest influence for both professional groups but was even more relevant for nurses than for physicians. *Perceived effectiveness* of reporting and *management support* both appeared to be more important for physicians than for nurses. *Role identity* had a much stronger influence on the *perceived effectiveness* for nurses than for physicians. Furthermore, *transparency* of the IRS procedure appeared to influence the perception of effectiveness for nurses, but not so for physicians.

Discussion

The system-related antecedents were most influential on the willingness to report. It was particularly important for physicians and nurses to know how to use the IRS (transparency). This suggests that improving the IRS procedures may increase the willingness to report and, eventually, reporting rates.

While fears and concerns towards incident reporting were apparent in the literature (e.g. [10, 37]) at the *individual level*, we found that stronger antecedents were: the extent to which respondents believed that reporting actually made

Table 7: Path coefficients and general fit indices of the structural model: IRS-related impacts.		
	Unstandardised	**Standardised**
Willingness to report	$R^2 = 0.549$	
Feedback → Willingness to report	0.05	0.03
Transparency procedure → Willingness to report	0.80**	0.67
Trust → Willingness to report	0.14**	0.09
Fit indices	CMIN = 258.95; df = 59	
	p <0.000	
	CMIN/df = 4.39	
	GFI = 0.950	
	RMSEA = 0.064	
	PCLOSE = 0.002	
	NFI = 0.936	
	TLI = 0.934	
n = 818 * p <0.05. ** p <0.01; abbreviations of fit indices explained in "Analysis" section		

Table 8: Path coefficients and general fit indices of the integrated structural model.		
	Unstandardised	**Standardised**
Willingness to report	$R^2 = 0.589$	
Perceived effectiveness → Willingness to report	0.33**	0.19
Transparency procedure → Willingness to report	0.73**	0.63
Management support → Willingness to report	0.11	0.12
Perceived effectiveness	$R^2 = 0.154$	
Role identity → Perceived effectiveness	0.26**	0.23
Transparency procedure → Perceived effectiveness	0.06	0.09
Management support → Perceived effectiveness	0.13	0.12
Role Identity	$R^2 = 0.165$	
Management support → Role Identity	0.33**	0.40
Fit indices	CMIN = 715.51; df = 128	
	p <0.000	
	CMIN/df = 5.590	
	GFI = 0.905	
	RMSEA = 0.075	
	PCLOSE = 0.000	
	NFI = 0.867	
	TLI = 0.881	
n = 818; * p <0.05, ** p <0.01; abbreviations of fit indices explained in "Analysis" section		

a difference in patient safety (perceived IRS-effectiveness) and how much they thought their peers and leaders expect reporting (subjective norm). Furthermore, clinicians who felt more attached to their hospital and team (role identity) had fewer fears towards reporting. For IRS in hospitals, the relevance of the perceived effectiveness means that they should be designed in a way that clinicians can actually experience how IRS contribute to learning from incidents, e.g. this could be achieved in providing more information on reported incidents and subsequent associated improvements [38].

Regarding the *organisation level antecedents*, management support was an important influence on the willingness to report, for physicians more than for nurses. Thus, IRS should explicitly be supported by management, especially for physicians. In contrast to findings from a study on reporting drug errors [32], psychological safety did not play an important role on the willingness to report. The small negative influence may be explained by suppression effects, i.e. *management support* may already have explained the little positive influence that *psychological safety* could have had on the *willingness to report* (correlation from *psychological safety* items with *willingness* ranges from r = 0.10 to r = 0.12). However, as reports are confidential and reporting involves no personal interaction, feeling psychologically safe may not be as important. Thus, in organisations with low psychological safety, confidential IRS can be a valuable means to start communicating about patient safety issues and learning from incidents in order to develop a "no-blame-culture" [39].

Regarding the *IRS-related antecedents*, the transparency of IRS procedures was relevant and it explained a large amount of the variance of the willingness to report. The transparency of the reporting procedure (which covered aspects of knowing how to proceed in reporting, how to fill in the form, which kind of event constitutes a reportable incident and training in the reporting procedure) are important topics to be addressed, even more so for nurses than for physicians. This result points to a need for more education in identifying incidents in healthcare, in accordance with Evans et al. [28] who stated that minor incidents may not be considered worth reporting. Trust in the competency and the confidentiality of the incident analysis was also relevant for the willingness to report. The irrelevance of feedback may be due to the fact that it intercorrelated highly with other IRS-related perceptions. Thus, its influence is subject to further analysis.

Multigroup analysis revealed that the motivational antecedents differ between professional groups in some aspects: for example, in addition to the transparency of the procedure, the perceived effectiveness of reporting was an important influence on the willingness to report, but only for physicians. The perceived effectiveness of reporting was significantly influenced by the transparency of the reporting procedure and the role identity for nurses but not for physicians.

Limitations and directions for further research

The data share a common method bias. To reduce biases stemming from high interrelations of constructs, the measurement properties were improved in assuring a good fit of the measurement models. Furthermore, the outcome variable was internally consistent and discriminant from the other dimensions.

This study does not take into account that the willingness to report may vary according to different kinds of incident. For example, Lawton and Parker [40] found that incident characteristics have an effect on their reporting. Further research should therefore aim to identify how motivational antecedents change when different types of incidents occur. Additionally, as management support proved to be relevant, future studies could differentiate different levels or styles of management, e.g. discerning between transactional and transformational leadership styles or different management levels [26].

The generalisability of the findings is limited by the response rate of 32%, because we cannot tell which motivational antecedents were relevant for non-responders.

Table 9: Path coefficients and general fit indices of the multigroup analysis: professional differences.

	Physicians		Nurses	
	Unstandardised	**Standardised**	**Unstandardised**	**Standardised**
Willingness to report	$R^2 = 0.647$		$R^2 = 0.580$	
Perc. effectiveness → Willingness to report	0.53**	0.30	0.17	0.10
Transparency procedure → Willingness to report	0.65**	0.60	0.85**	0.68
Management → Willingness to report	0.19	0.15	0.12	0.09
Perceived effectiveness	$R^2 = 0.096$		$R^2 = 0.210$	
Role identity → Perceived effectiveness	0.14	0.17	0.27**	0.28
Transparency proc. → Perceived effectiveness	0.01	0.01	0.17**	0.23
Management support → Perceived effectiveness	0.16	0.22	0.08	−0.10
Role Identity	$R^2 = 0.093$		$R^2 = 0.203$	
Management support → Role Identity	0.26**	0.31	0.35**	0.45
Fit indices	CMIN = 842.90; df =256			
	p <0.000			
	CMIN/df = 3.293			
	GFI = 0.886			
	RMSEA = 0.054			
	PCLOSE = 0.037			
	NFI = 0.841			
	TLI = 0.876			
Invariance of measurement model was assumed. Nurses: n = 546; physicians: n = 230; * p <0.05, ** p <0.01; abbreviations of fit indices explained in "Analysis" section				

However, our sample consists of a mix of different specialties and IRS, which is positive for the generalizability. Evaluated data originated from various Swiss hospital contexts and were not assessed in one single hospital using a particular kind of IRS. Since this study is centred on IRS practices in Swiss healthcare, its generalizability to other national settings remains to be determined. Investigating the role of national healthcare policies and contexts on the motivation to report incidents will therefore be subject to further study.

Conclusions

This study helps prioritise management actions in designing and implementing IRS for healthcare organisations by providing evidence on what motivates clinicians to report incidents.

While prior research reported barriers to incident reporting in a descriptive way, the use of an outcome variable in this study helped to identify the relative relevance of the proposed motivational antecedents. We identified different motivational antecedents for the professional groups of nurses and physicians, e.g. the perceived effectiveness being particularly important for physicians. The inclusion of role identity as a distant variable proved to be useful, as it influenced relevant antecedents for the willingness to report.

For advancing the use of IRS in hospitals, practitioners and researchers need to develop ideas on how to make IRS effects visible and how best to improve the transparency of reporting procedures, especially for nurses. IRS design should facilitate experiences demonstrating that they actually improve patient safety possibly by facilitating the participation of clinicians in the core IRS learning processes of event analysis and improvement.

Today, reporting an incident requires a proactive orientation that aims at positively influencing the work situation, but IRS offer very restricted possibilities to actually participate in the overall improvement process. In order to improve IRS, hospitals should consider involving clinicians more in all processes towards establishing effective IRS.

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Figures (large format)

Figure 1
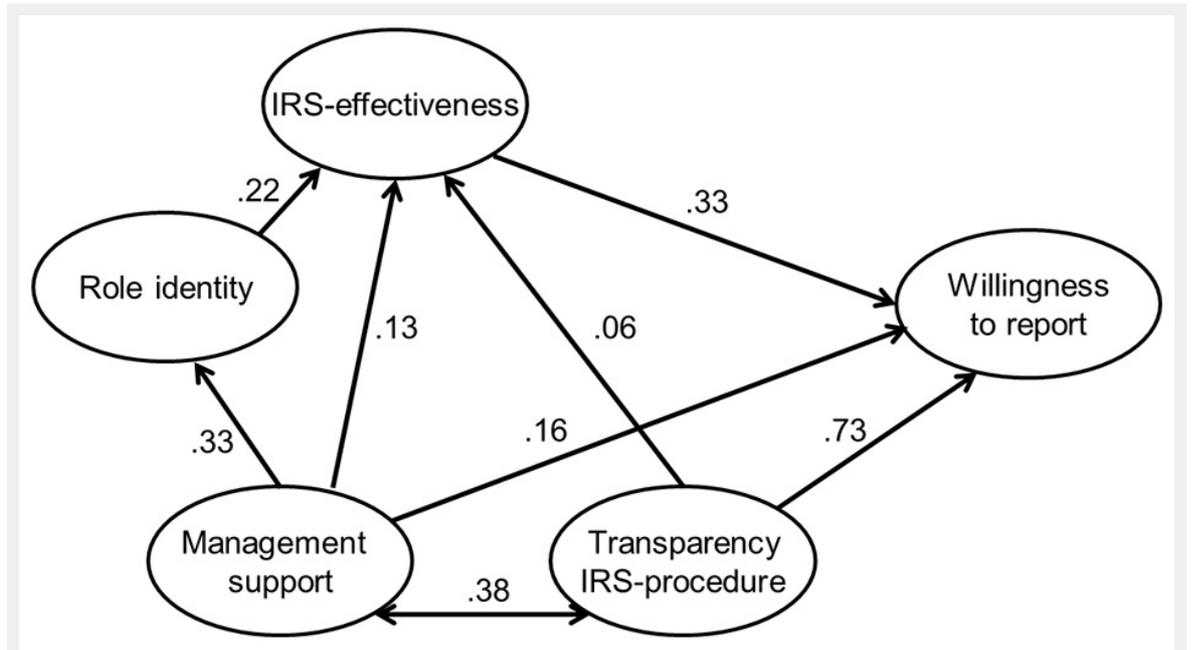
Integrated model of motivational antecedents, the figures indicating the unstandardised path coefficients.